



## GENERAL ENGINEERING LABORATORY



SUPPORTING
SHORT RANGE AIDS TO NAVIGATION

The General Engineering Laboratory was created through the General Engineering Laboratory Support (GELS) Project to support Coast Guard engineering Aids to Navigation (AtoN) activities. The laboratory is currently engaged in several projects affecting the ATON environment. These projects cover a broad range of topics from Light Emitting Diodes for Coast Guard lights to new adhesives and colors for day marker applications. Every project undertaken by the General Engineering Laboratory is in support of the Coast Guards Aids to Navigation program.

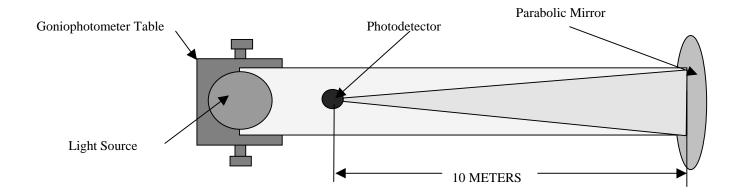
The support is achieved on several fronts. Some projects lead to new technologies, some lead to lower costs for equipment or maintenance, and some projects insure the quality of existing equipment is maintained. That means that the general engineering lab has to maintain the capabilities to conduct first article testing for potential Coast Guard equipment all the way through to quality assurance testing of in-stock equipment.

To achieve this level of support, the laboratory staff maintains the following facilities:

A zero length photometric light tunnel
An optics lab
A lamp life test lab
On and Off site outdoor exposure sites
A pressure, immersion, and temperature tank set up
An Integrating Sphere used to measure total lumen output
A walk in Environmental Chamber

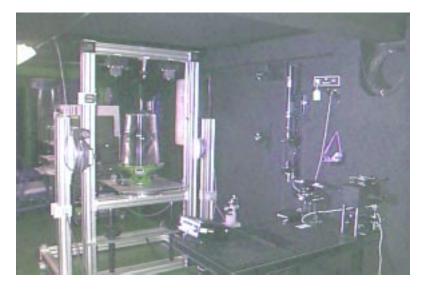
The Light Tunnel

The GELS light tunnel is primarily used for intensity measurements of AtoN lamps and optics. The light tunnel employs a technique known as "Zero Length Photometry", where a parabolic mirror is used to simulate the light source being in the "far field". The major components that make up the light tunnel are; the goniophotometer, the mirror, the controller, the photometer, and the computer.



## ZERO-LENGTH PHOTOMETERY LIGHT TUNNEL SET UP

The goniophotometer is a device capable of rotating an optic about a horizontal and vertical axis. This is accomplished with two rotational motors tied to a rectangular frame. The mounting platform can hold a 36" diameter optic and can be raised or lowered so the centerline of the optic matches the rotational axis of the goniophotometer. This is verified each time using the recently installed laser alignment system. The optic can then be rotated horizontally, at 0.002 degree increments, and vertically, at 0.001 degree increments. These movements are computer controlled and intensity readings are taken at programmable intervals. The computer also collects the photometric data and prints out the collected data in tabular and graphical form.





GONIOPHOTOMETER AND LASER ALIGNMENT SYSTEM

36" MIRROR

The glass mirror is 36" in diameter with a 10meter focal length, is 8" thick, and weighs 2,000 lbs. It has front surface reflective coatings that prevent light losses from absorption or internal reflection. A silicon detector, interfaced to the computer, is placed at the exact focal point of the mirror. Only the parallel rays of light coming from the optic are focused on the detector.

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The Optics Laboratory

The GELS optics lab is used for a variety of tests and measurements. The central feature of the lab is a 4 X 10 foot, vibration damped, optics bench. This work surface allows lab personnel to set up a variety of test or measurement procedures. The lab is fully equipped for color measurements of light sources, lanterns, and colored surfaces such as dayboards. A choice of scanning monochromators allows spectral power measurements from the near infrared to ultraviolet wavelengths.



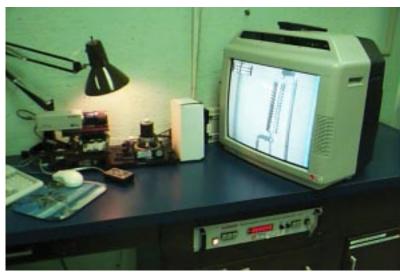
Monochromator on Optics Bench



One Meter Integrating Sphere

Radiometric measurements can be made in nearly any unit or at any power level. One recent project called for the measuring of the color of sealed unit LED buoy lights. The computer controlled monochromators, radiometers, and photometers coupled with the flexibility of the lab allows this type of diversity. Standard Lamps which are directly traceable to the National Institute of Standards and Technology (NIST) are maintained in the lab. These lamps are used for calibration of detectors and comparative measurements of CG lamps. A storage oscilloscope allows measurements of rapid events such as the incandescence and nigrescence of flashed lamps. A one meter integrating sphere is available for lumen output measurement of lamps used in AtoN optics. It is also used to calibrate or create "working standards".

Another novel system in the optics lab allows non-destructive measurement of lamp filament lengths, widths, and light center lengths (LCL). The system utilizes a rotational drive and an inspection microscope coupled to a TV camera which allows a full 360 degree check. The view of the lamp filament is displayed on a TV monitor. Electronic crosshairs are superimposed on the picture of the filament. Measurements are recorded electronically for evaluation at a later date. Video tape inputs are available for a visual recording if desired or digitally generated 'snaps' can be taken right on the computer.



Physical Measurements Apparatus

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Lamp Life Test Laboratory

The life test lab is a small room designed to operate multiple lamps for long periods of time. One power supply can handle as many as 10 lamps with a total load of up to 200 amps. Other power supplies, of smaller capacity, operate single lamps or single systems. Lamps are computer controlled and monitored for predetermined on and off times. Voltage and current of each lamp (up to 10) can be monitored for the duration of the test and failures are automatically recorded. Lumen output of the lamps is measured at regular intervals throughout the test period. Those measurements are made in the integrating sphere using a simple ratio technique.



Life Test Setup for 12VDC Lamps

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**Outdoor Laboratories** 

There are two onsite outdoor locations where either real time environmental exposure tests or human factors testing can be conducted. The first site is the roof of the R&D Center and has a commanding view of Long Island Sound. Observations of the various test optics can be made from a vessel. Twenty mile lines of sight are possible. The roof top facility is about 80 feet above the water level. This height allowed the recent evaluation of a LASER line of light which could be used as a range light. The second site offers direct marine exposure to equipment with part of the site situated on a jetty. Over the years the outdoor test sites have been used for photovoltaic panel testing (as large as 120VDC), bird deterrent testing for buoy lights and solar panels, evaluation of hybrid power sources, and real time environmental exposure of daymark materials. The General Engineering Lab also conducts field testing with the support of operational units. Currently ANT Buffalo, NY, ANT St Petersburg, FL and ANT Moriches, NY are assisting in a five year evaluation of new dayboard materials.

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## The AtoN Equipment Museum



Working Museum to AtoN Equipment

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